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(54) **SPATIAL RECOGNITION AND GROUPING OF TEXT AND GRAPHICS**

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See application file for complete search history.

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(57) **ABSTRACT**

The present invention leverages spatial relationships to provide a systematic means to recognize text and/or graphics. This allows augmentation of a sketched shape with its symbolic meaning, enabling numerous features including smart editing, beautification, and interactive simulation of visual languages. The spatial recognition method obtains a search-based optimization over a large space of possible groupings from simultaneously grouped and recognized sketched shapes. The optimization utilizes a classifier that assigns a class label to a collection of strokes. The overall grouping optimization assumes the properties of the classifier so that if the classifier is scale and rotation invariant the optimization will be as well. Instances of the present invention employ a variant of AdaBoost to facilitate in recognizing/classifying symbols. Instances of the present invention employ dynamic programming and/or A-star search to perform optimization. The present invention applies to both hand-sketched shapes and printed handwritten text, and even heterogeneous mixtures of the two.

44 Claims, 19 Drawing Sheets